

What is claimed is:

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- 1 An apparatus for converting an input voice signal into an output voice signal according to a reference voice signal, the apparatus comprising:  
extracting means for extracting a plurality of sinusoidal wave components from the input voice signal;  
memory means for memorizing pitch information representative of a pitch of the reference voice signal;  
modulating means for modulating a frequency of each sinusoidal wave component according to the pitch information retrieved from the memory means; and  
mixing means for mixing the plurality of the sinusoidal wave components having the modulated frequencies to synthesize the output voice signal having a pitch different from that of the input voice signal and influenced by that of the reference voice signal.
- 2 The apparatus as claimed in claim 1, further comprising control means for setting a control parameter effective to control a degree of modulation of the frequency of each sinusoidal wave component by the modulating means so that a degree of influence of the pitch of the reference voice signal to the pitch of the output voice signal is determined according to the control parameter.
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- 3 The apparatus as claimed in claim 1, wherein the memory means comprises means for memorizing primary pitch information representative of a discrete pitch matching a music scale, and secondary pitch information

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representative of a fractional pitch fluctuating relative to the discrete pitch, and wherein the modulating means comprises means for modulating the frequency of each sinusoidal wave component according to both of the primary pitch information and the secondary pitch information.

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4 The apparatus as claimed in claim 1, further comprising detecting means for detecting a pitch of the input voice signal based on results of extraction of the sinusoidal wave components, and switch means operative when the detecting means does not detect the pitch from the input voice signal for outputting an original of the input voice signal in place of the synthesized output voice signal.

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5 The apparatus as claimed in claim 1, wherein the memory means further comprises means for memorizing amplitude information representative of amplitudes of sinusoidal wave components contained in the reference voice signal, and the modulating means further comprises means for modulating an amplitude of each sinusoidal wave component of the input voice signal according to the amplitude information, so that the mixing means mixes the plurality of the sinusoidal wave components having the modulated amplitudes to synthesize the output voice signal having a timbre different from that of the input voice signal and influenced by that of the reference voice signal.

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6 The apparatus as claimed in claim 5, further comprising means for setting a control parameter effective to control a degree of modulation of the amplitude of each sinusoidal wave component by the modulating means so

that a degree of influence of the timbre of the reference voice signal to the timbre of the output voice signal is determined according to the control parameter.

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7 The apparatus as claimed in claim 1, further comprising means for memorizing volume information representative of a volume variation of the reference voice signal, and means for varying a volume of the output voice signal according to the volume information so that the output voice signal emulates the volume variation of the reference voice signal.

8 The apparatus as claimed in claim 1, further comprising means for separating a residual component from the input voice signal after extraction of the sinusoidal wave components, and means for adding the residual component to the output voice signal.

9 An apparatus for converting an input voice signal into an output voice signal according to a reference voice signal, the apparatus comprising:

extracting means for extracting a plurality of sinusoidal wave components from the input voice signal;  
memory means for memorizing amplitude information representative of amplitudes of sinusoidal wave components contained in the reference voice signal;

modulating means for modulating an amplitude of each sinusoidal wave component extracted from the input voice signal according to the amplitude information retrieved from the memory means; and

mixing means for mixing the plurality of the sinusoidal wave components having the modulated amplitudes to synthesize the output voice signal having a timbre different from that of the input voice signal and influenced by that of the reference voice signal.

10 The apparatus as claimed in claim 9, further comprising control means for setting a control parameter effective to control a degree of modulation of the amplitude of each sinusoidal wave component by the modulating means so that a degree of influence of the timbre of the reference voice signal to the timbre of the output voice signal is determined according to the control parameter.

11 The apparatus as claimed in claim 9, wherein the memory means further memorizes pitch information representative of a pitch of the reference voice signal, and the modulating means further modulates a frequency of each sinusoidal wave component of the input voice signal according to the pitch information, so that the mixing means mixes the plurality of the sinusoidal wave components having the modulated frequencies to synthesize the output voice signal having a pitch different from that of the input voice signal and influenced by that of the reference voice signal.

12 The apparatus as claimed in claim 11, further comprising means for setting a control parameter effective to control a degree of modulation of the frequency of each sinusoidal wave component by the modulating means so that a degree of influence of the pitch of the reference voice signal to the pitch

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of the output voice signal is determined according to the control parameter.

13 The apparatus as claimed in claim 11, wherein the memory means comprises means for memorizing primary pitch information representative of a discrete pitch matching a music scale, and secondary pitch information representative of a fractional pitch fluctuating relative to the discrete pitch, and wherein the modulating means comprises means for modulating the frequency of each sinusoidal wave component according to both of the primary pitch information and the secondary pitch information.

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14 The apparatus as claimed in claim 9, further comprising detecting means for detecting a pitch of the input voice signal based on results of extraction of the sinusoidal wave components, and switch means operative when the detecting means does not detect the pitch from the input voice signal for outputting an original of the input voice signal in place of the synthesized output voice signal.

15 The apparatus as claimed in claim 9, further comprising means for memorizing volume information representative of a volume variation of the reference voice signal, and means for varying a volume of the output voice signal according to the volume information so that the output voice signal emulates the volume variation of the reference voice signal.

16 The apparatus as claimed in claim 9, further comprising means for

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separating a residual component from the input voice signal after extraction of the sinusoidal wave components, and means for adding the residual component to the output voice signal.

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17 An apparatus for synthesizing an output voice signal from an input voice signal and a reference voice signal, the apparatus comprising:

an analyzer device that analyzes a plurality of sinusoidal wave components contained in the input voice signal to derive a parameter set of an original frequency and an original amplitude representing each sinusoidal wave component;

a source device that provides reference information characteristic of the reference voice signal;

a modulator device that modulates the parameter set of each sinusoidal wave component according to the reference information; and

a regenerator device that operates according to each of the parameter sets as modulated to regenerate each of the sinusoidal wave components so that at least one of the frequency and the amplitude of each sinusoidal wave component as regenerated varies from original one, and that mixes the regenerated sinusoidal wave components altogether to synthesize the output voice signal.

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18 The apparatus as claimed in claim 17, wherein the source device provides the reference information characteristic of a pitch of the reference voice signal, and wherein the modulator device modulates the parameter set of each sinusoidal wave component according to the reference information so

F) that the frequency of each sinusoidal wave component as regenerated varies from the original frequency, thereby the pitch of the output voice signal being synthesized according to the pitch of the reference voice signal.

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e7* 19 The apparatus as claimed in claim 18, wherein the source device provides the reference information characteristic of both of a discrete pitch matching a music scale and a fractional pitch fluctuating relative to the discrete pitch, thereby the pitch of the output voice signal being synthesized according to both of the discrete pitch and the fractional pitch of the reference voice signal.

E1 20 The apparatus as claimed in claim 17, wherein the source device provides the reference information characteristic of a timbre of the reference voice signal, and wherein the modulator device modulates the parameter set of each sinusoidal wave component according to the reference information so that the amplitude of each sinusoidal wave component as regenerated varies from the original amplitude, thereby the timbre of the output voice signal being synthesized according to the timbre of the reference voice signal.

21 The apparatus as claimed in claim 17, further comprising a control device that provides a control parameter effective to control the modulator device so that a degree of modulation of the parameter set is variably determined according to the control parameter.

22 The apparatus as claimed in claim 17, further comprising a detector

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device that detects a pitch of the input voice signal based on analysis of the sinusoidal wave components by the analyzer device, and a switch device operative when the detector device does not detect the pitch from the input voice signal for outputting an original of the input voice signal in place of the synthesized output voice signal.

23 The apparatus as claimed in claim 17, further comprising a memory device that memorizes volume information representative of a volume variation of the reference voice signal, and a volume device that varies a volume of the output voice signal according to the volume information so that the output voice signal emulates the volume variation of the reference voice signal.

24 The apparatus as claimed in claim 17, further comprising a separator device that separates a residual component other than the sinusoidal wave components from the input voice signal, and an adder device that adds the residual component to the output voice signal.

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25 A method of converting an input voice signal into an output voice signal according to a reference voice signal, the method comprising the steps of:

extracting a plurality of sinusoidal wave components from the input voice signal;

memorizing pitch information representative of a pitch of the reference voice signal;

modulating a frequency of each sinusoidal wave component according to the memorized pitch information; and

mixing the plurality of the sinusoidal wave components having the modulated frequencies to synthesize the output voice signal having a pitch different from that of the input voice signal and influenced by that of the reference voice signal.

26 A method of converting an input voice signal into an output voice signal according to a reference voice signal, the method comprising the steps of:

extracting a plurality of sinusoidal wave components from the input voice signal;

memorizing amplitude information representative of amplitudes of sinusoidal wave components contained in the reference voice signal;

modulating an amplitude of each sinusoidal wave component extracted from the input voice signal according to the memorized amplitude information; and

mixing the plurality of the sinusoidal wave components having the modulated amplitudes to synthesize the output voice signal having a timbre different from that of the input voice signal and influenced by that of the reference voice signal.

27 A machine readable medium used in a computer machine having a CPU for synthesizing an output voice signal from an input voice signal and a reference voice signal, the medium containing program instructions

executable by the CPU for causing the computer machine to perform the method comprising the steps of:

analyzing a plurality of sinusoidal wave components contained in the input voice signal to derive a parameter set of an original frequency and an original amplitude representing each sinusoidal wave component;

providing reference information characteristic of the reference voice signal;

modulating the parameter set of each sinusoidal wave component according to the reference information;

regenerating each of the sinusoidal wave components according to each of the modulated parameter sets so that at least one of the frequency and the amplitude of each regenerated sinusoidal wave component varies from original one; and

mixing the regenerated sinusoidal wave components altogether to synthesize the output voice signal.

